PATENT

OPTICAL TERMINATION PEDESTAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to a pedestal adapted for use in a fiber optic communications network, and more specifically, to an optical termination pedestal adapted for interconnecting an optical fiber of a distribution cable and an optical fiber of a fiber optic drop cable within an interior cavity defined by the pedestal.

2. Description of the Related Art

[0002] Optical fiber is increasingly being used for a variety of broadband applications including voice, video and data transmissions. As a result of the ever-increasing demand for broadband communications, fiber optic networks typically include a large number of mid-span access locations at which one or more optical fibers are branched from a distribution cable. These mid-span access locations provide a branch point from the distribution cable leading to an end user, commonly referred to as a subscriber, and thus, may be used to extend an "all optical" communications network closer to the subscriber. In this regard, fiber optic networks are being developed that deliver "fiber-to-the-curb" (FTTC), "fiber-to-the-business" (FTTB), "fiber-to-the-home" (FTTH), or "fiber-to-the-premises" (FTTP), referred to generically as "FTTx." Based on the increased number of mid-span access locations and the unique demands of the optical fibers and optical connections, optical termination pedestals are needed for routing, protecting, and managing optical fibers and optical connections in an FTTx network. Optical termination pedestals are also needed for interconnecting optical fibers branched from the distribution cable with optical fibers of fiber optic drop cables at locations that are readily accessible to a craftsperson. Thus, it would be desirable in an FTTx

network to provide an optical termination pedestal that is operable to interconnect an optical fiber of a feeder cable, distribution cable or branch cable with an optical fiber of a fiber optic drop cable in a substantially sealed environment at a readily accessible location.

[0003] In one example of a fiber optic communications network, one or more drop cables are interconnected with a distribution cable at a mid-span access location. Substantial expertise and experience are required to configure the optical connections in the field. In particular, it is often difficult to identify an optical fiber of the distribution cable to be interconnected with an optical fiber of a particular drop cable. Once identified, the optical fibers of the drop cables are typically joined directly to the optical fibers of the distribution cable at the mid-span access location using conventional splicing techniques, such as fusion splicing. In other instances, the optical fibers of the drop cables and the optical fibers of the distribution cable are first spliced to a short length of optical fiber having an optical connector mounted on the other end, referred to in the art as a "pigtail." The pigtails are then routed to opposite sides of a connector adapter sleeve to connect the drop cable to the distribution cable. In either case, the process of configuring the mid-span access location is not only time consuming, but frequently must be accomplished by a highly skilled field technician at significant cost and under field working conditions that are less than ideal. In networks in which a mid-span access location is enclosed within a splice closure, reconfiguring the optical fiber connections in the splice closure is especially difficult, based in part on the inaccessible location of the closure and the inability to readily remove the closure from the distribution cable. Further, once the optical connections are made, it is often labor intensive, and therefore costly, to reconfigure the existing optical connections or to add additional optical connections.

[0004] In order to reduce costs by permitting less experienced and less skilled technicians to perform optical connections and reconfigurations at mid-span access locations in the field, communications service providers are increasingly pre-engineering new fiber optic networks and demanding factory-prepared interconnection solutions, commonly referred to as "plug-and-play" type systems. Pre-engineered networks, however, require that the location of at least some of the branch points in the network be predetermined prior to the distribution cable being deployed. More particularly, pre-engineered solutions require precise location of the factory-prepared mid-span access locations where the preterminated, and sometimes pre-

connectorized, optical fibers of the distribution cable are made available for interconnection with optical fibers of drop cables extending from the subscriber premises. Thus, with regard to a factory-prepared interconnection solution, it would be desirable to provide an optical termination pedestal in which optical fibers of a plurality of drop cables can be readily connected to optical fibers branched from a distribution cable. It would also be desirable to provide an optical termination pedestal having one or more connector ports located within an interior cavity defined by the pedestal and operable for receiving a connectorized optical fiber of the distribution cable on one side of the connector port and a pre-connectorized fiber optic drop cable on the other side of the connector port. It would further be desirable to provide an optical termination pedestal for use in a pre-engineered FTTx network that can be readily accessed and reconfigured after installation by a less experienced and less skilled field technician.

BRIEF SUMMARY OF THE INVENTION

[0005] To achieve the foregoing and other objects, and in accordance with the purpose of the present invention as embodied and broadly described herein, the present invention provides various embodiments of an optical termination pedestal including a housing configured as a "canister" or "butt" type closure that may be mounted onto a conventional pedestal base or onto a base incorporated into a below-grade vault or hand hole. A plate disposed within the housing is provided with a seal between the housing and the periphery of the plate. The plate may serve as a bulkhead with one or more connector ports mounted on the plate for receiving a connectorized optical fiber of a distribution cable on one side of the connector port and a pre-connectorized fiber optic drop cable on the other side of the connector port. The plate also has one or more cable entrance and exit ports for routing the distribution cable and any fiber optic drop cables utilized in forming optical connections, for example, by fusion splicing or by interconnecting pigtails through a connector adapter sleeve. The plate separates the interior cavity of the optical termination pedestal into a first compartment for managing terminated optical fibers and optical connections and a second compartment for receiving the distribution cable and the drop cables. Advantageously, the plate substantially seals the first compartment relative to the second compartment and thereby prevents moisture from entering the first compartment, for example in the event of a flood condition. An optical termination

pedestal according to the present invention permits a field technician to establish desired optical connections in a fiber optic communications network and to reconfigure optical connections after initial installation of the pedestal at a convenient mid-span access location along the length of a feeder cable, a distribution cable or a branch cable of a fiber optic network.

[0006] In an exemplary embodiment, the present invention provides an optical termination pedestal defining an interior cavity for housing fiber optic cables, optical fibers and optical connections. The optical termination pedestal includes a base, a housing positioned over the base, a distribution cable received within the interior cavity, at least one drop cable received within the interior cavity, and a means for interconnecting at least one optical fiber of the distribution cable with at least one optical fiber of at least one drop cable. The optical termination pedestal further includes a plate disposed within the interior cavity that separates the interior cavity into a first compartment and a second compartment and is operable to substantially seal the first compartment relative to the second compartment. The plate also provides one or more cable ports for routing at least one of the distribution cable and the drop cable into the first compartment. At least one optical fiber is branched, also referred to herein as "terminated," from the distribution cable in the first compartment and is optically connected by the means for interconnecting to at least one optical fiber of a fiber optic drop cable in the first compartment or in the second compartment.

[0007] In yet another exemplary embodiment, the present invention provides an optical termination pedestal defining an interior cavity for forming optical fiber connections. The optical termination pedestal comprises a base for locating the pedestal in the ground, a housing positioned over the base, a distribution cable received within the interior cavity, at least one drop cable received within the interior cavity and a mounting plate disposed within the interior cavity that operates to separate the interior cavity into a first compartment and a second compartment and further operates to substantially seal the first compartment relative to the second compartment. Terminated and connectorized optical fibers of the distribution cable in the first compartment are optically connected to one side of the connector ports mounted on the mounting plate, while one or more pre-connectorized fiber optic drop cables in the second compartment are optically connected to the other side of the connector ports.

[0008] In yet another exemplary embodiment, the present invention provides an optical termination pedestal for use at a branch point, such as a mid-span access location, in a fiber optic communications network. The optical termination pedestal defines an interior cavity and comprises a base, a housing positioned over the base and a plate disposed within the interior cavity. The plate is operable for separating the interior cavity into a first compartment and a second compartment and for substantially sealing the first compartment relative to the second compartment. The plate also defines one or more cable entrance and exit ports for routing the distribution cable into and out of the first compartment and for routing at least one drop cable into the first compartment. At least one terminated optical fiber of the distribution cable in the first compartment is optically connected to an optical fiber of at least one drop cable in the first compartment. Alternatively, at least one terminated optical fiber of the distribution cable in the first compartment may be first connectorized and then optically connected to a pre-connectorized fiber optic drop cable in the first compartment through an interconnection means, such as a conventional connector adapter sleeve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] These and other features, aspects and advantages of the present invention are better understood when the following detailed description of the invention is read with reference to the accompanying drawings, wherein:

[0010] FIG. 1 is a perspective view of an optical termination pedestal defining an interior cavity and including a base, a housing positioned over the base, a mounting plate disposed within the interior cavity and secured to the housing, and a pre-connectorized fiber optic drop cable optically connected to a connectorized optical fiber of a distribution cable through a connector port mounted on the mounting plate in accordance with an exemplary embodiment of the present invention;

[0011] FIG. 2 is a perspective view of an optical termination pedestal defining an interior cavity and including a base, a removable housing positioned over the base, a mounting plate disposed within the interior cavity and secured to the base, and a pre-connectorized fiber optic drop cable optically connected to a connectorized optical fiber of a distribution cable through

a connector port mounted on the mounting plate in accordance with another exemplary embodiment of the present invention;

[0012] FIG. 3 is a perspective view of an optical termination pedestal defining an interior cavity and including a base, a housing positioned over the base, a mounting plate secured to the housing, and a plurality of access doors operable for providing access to the interior cavity in accordance with another exemplary embodiment of the present invention;

[0013] FIG. 4 is a perspective view of an optical termination pedestal defining an interior cavity and including a base, a housing positioned over the base, a mounting plate secured to the housing or the base, and a sliding ring for providing access to a lower portion of the interior cavity in accordance with another exemplary embodiment of the present invention;

[0014] FIG. 5 is a perspective view of the optical termination pedestal of FIG. 4 with the sliding ring shown in a raised position to expose the lower portion of the interior cavity;

[0015] FIG. 6 is a perspective view of an optical termination pedestal defining an interior cavity and including a base, a housing positioned over the base, at least one access door for providing access to the interior cavity, a horizontal mounting plate secured to the housing, and a plurality of connector ports mounted on a vertical mounting plate in accordance with another exemplary embodiment of the present invention;

[0016] FIG. 7 is a perspective view of an optical termination pedestal defining an interior cavity and including a base, a housing positioned over the base, a plate secured to the housing and having a plurality of cable entrance and exit ports, and at least one optical fiber of a drop cable spliced to at least one optical fiber of a distribution cable in accordance with an exemplary embodiment of the present invention; and

[0017] FIG. 8 is a perspective view of an optical termination pedestal defining an interior cavity and including a base, a removable housing positioned over the base, a plate secured to the base and having a plurality of cable entrance and exit ports, and a means for interconnecting at least one connectorized optical fiber of a drop cable to at least one connectorized optical fiber of a distribution cable in accordance with another exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0018] The present invention will now be described more fully hereinafter with reference to the accompanying drawings in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. These exemplary embodiments are shown and described so that this disclosure will be both thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like reference numbers refer to like elements throughout the various drawings.

[0019] The present invention provides various embodiments of an optical termination pedestal defining an interior cavity adapted for housing fiber optic cables, terminated optical fibers and optical connections, and for sealing the terminated optical fibers and optical connections against adverse environmental conditions, such as dust, dirt, infestation and moisture, and in particular, a flood condition. The optical termination pedestal comprises a plate that is secured within the interior cavity defined by the pedestal and separates the interior cavity into a first compartment and a second compartment. At least one cable port is provided on the plate and is operable for passing a distribution cable therethrough. In the embodiments shown and described herein, the plate is provided with both a cable entrance port and a cable exit port for routing the distribution through the pedestal. The distribution cable enters and exits the pedestal at the lower end of the housing to form a "butt" or "canister" type pedestal. However, the manner in which the distribution cable is routed into, through and out of the pedestal depends on the configuration of the plate and whether the housing is positioned over a conventional pedestal base or over a base incorporated into a below-ground vault or hand hole. In several embodiments, one or more connector ports are mounted on the plate and operable for receiving connectorized optical fibers of the distribution cable on one side of the connector port and pre-connectorized fiber optic drop cables on the other side of the connector port. Each connector port may include a connector adapter sleeve disposed within the connector port or may be configured to receive the mating optical connectors in any manner now known or hereafter devised. Furthermore, the connector port may be configured to form an optical connection between optical fibers in any suitable manner. Regardless, each connector port is operable for establishing an optical connection between a connectorized

optical fiber of the distribution cable and a respective optical fiber of a pre-connectorized drop cable.

[0020] In several of the embodiments illustrated herein, terminated optical fibers of the distribution cable are first connectorized and then routed to the connector ports in the first compartment of the interior cavity. The terminated optical fibers accessed from the distribution cable may be spliced to optical fibers having optical connectors mounted on the end (i.e., "pigtails"), which are then routed to the connector ports. Alternatively, a connector may be mounted directly on the end of the terminated optical fiber (i.e., direct connectorized) or a field-installable connector having a stub fiber may be fusion spliced or mechanically spliced to the terminated optical fiber. Other optical fibers of the distribution cable may be managed and routed separately from the terminated optical fibers such that they extend uninterrupted through the pedestal. Once the desired optical fibers are accessed, terminated, connectorized and routed to the connector ports, the housing may be positioned over the base and the first compartment sealed using the plate. One or more pre-connectorized drop cables are then routed to the other side of the connector ports from the second compartment of the housing at any time subsequent to the initial installation of the pedestal without requiring access to the first compartment. The size of the pedestal and the plate may vary depending upon the number of connector ports required, the minimum bend radius of the distribution cable, and the number of optical components and the amount of slack optical fiber stored within the pedestal. However, the diameter of the pedestal typically does not exceed about eight inches. In all embodiments, different distribution cable types may be accommodated, such as monotube, loose tube, central tube, ribbon and the like. In all embodiments, the connector ports may be adapted to accommodate a variety of connector types, such as but not limited to SC, LC, DC, FC, ST, SC/DC, MT-RJ, MTP and MPO ferrules.

[0021] In all embodiments shown and described herein, the plate disposed within the housing defines one or more cable entrance and exit ports for routing one or more fiber optic cables from the second compartment into the first compartment. In particular, the cable ports route the distribution cable into and out of the first compartment, and in some embodiments, also route at least one drop cable into the first compartment. One example of a type of distribution cable that may be used in conjunction with present invention is an ALTOS® dielectric cable

available from Corning Cable Systems LLC of Hickory, NC. The ALTOS® dielectric cable is a lightweight fiber optic cable designed for both conduit (buried) and aerial (lashed) installations. In another example, the distribution cable is a Standard Single-Tube Ribbon (SST-Ribbon™) cable available from Corning Cable Systems LLC of Hickory, NC. The SST-Ribbon™ cable contains readily identifiable twelve-fiber ribbons in a gel-filled tube. Regardless, the distribution cable is preferably designed to provide stable performance over a wide range of temperatures and to be compatible with any telecommunications grade optical fiber. As used herein, the term "optical fiber" is intended to include all types of single mode and multi-mode light waveguides, including one or more bare optical fibers, coated optical fibers, loose-tube optical fibers, tight-buffered optical fibers, ribbonized optical fibers or any other expedient for transmitting light signals. In preferred embodiments, the distribution cable is flexible, easy to route and has no preferential bend. The distribution cable is routed into the housing through a pedestal base, for example, a base secured into the ground or a base incorporated into a below-grade vault or hand hole.

[0022] In a fiber optic communications network for use with the invention, one or more branch points are provided at mid-span access locations along the length of the distribution cable. The branch points may be created in the field by a known mid-span access procedure or may be created in the factory, such as a preterminated or pre-connectorized fiber optic distribution cable for a pre-engineered fiber optic network. At each mid-span access location, one or more optical fibers are identified, accessed, severed and branched from the distribution cable, resulting in one or more terminated optical fibers. In one embodiment, the terminated optical fibers are spliced directly to optical fibers of one or more drop cables. In other embodiments, the terminated optical fibers are first connectorized (i.e., an optical connector is mounted on the end of the terminated optical fiber). As previously described, the optical connector may be direct connectorized to the end of the terminated optical fiber. Alternatively, a field installable connector may be spliced (e.g., mechanically spliced or fusion spliced) to the terminated optical fiber. Still further, the terminated optical fiber may be first spliced to a short length of optical fiber having an optical connector attached at the other end (i.e., a pigtail). Regardless, the connectorized optical fibers of the distribution cable are routed to one side of a connector port and optically connected to respective optical fibers of a pre-connectorized drop cable on the other side of the connector port.

[0023] The mid-span access locations may be factory-prepared by skilled artisans in a controlled environment, or may be prepared in the field by a highly skilled field technician. In a factory-prepared mid-span access location, a portion of the cable sheath of the distribution cable is removed to expose a predetermined length of an underlying tubular body, such as a buffer tube, containing a plurality of optical fibers. Pre-selected optical fibers are then accessed from the tubular body and severed (i.e., preterminated) from the distribution cable. The mid-span access location may then be repaired and the preterminated optical fibers protected with a small form shipping and installation enclosure, which is preferably removed after the distribution cable is deployed. In a field-prepared mid-span access location, a portion of the cable sheath of the distribution cable is removed in the field by a highly skilled field technician (also referred to as a craftsman) to expose a predetermined length of an underlying tubular body, such as a buffer tube, containing a plurality of optical fibers. Pre-selected optical fibers are then accessed and terminated, and if desired, connectorized, as previously described. In both the factory-prepared and field-prepared mid-span access locations, the distribution cable and drop cables, the branch point, the terminated optical fibers, and the optical connections are routed, managed and protected within the housing. Typically, a pre-selected number of optical fibers of the distribution cable (e.g., four) are terminated for interconnection with optical fibers of one or more drop cables, while the remainder of the optical fibers extend uninterrupted through the optical termination pedestal to another mid-span access location.

[0024] Referring now to FIG. 1, an optical termination pedestal **20** constructed in accordance with an exemplary embodiment of the present invention is shown. The optical termination pedestal **20**, also referred to herein as pedestal **20**, permits an optical fiber of one or more fiber optic drop cables **22** to be readily interconnected with a field-terminated or factory-preterminated optical fiber **24** of a fiber optic distribution cable **26**. In this embodiment, the optical fiber **24** is also connectorized, and in particular, is spliced to a relatively short length of optical fiber having an optical connector mounted on the end (i.e., a pigtail). As is well known and understood in the art, each drop cable **22** comprises a flexible transport tube containing one or more optical fibers connected to an outside plant optical connection terminal, such as a network interface deice (NID) at a subscriber premises. As shown, the fiber optic drop cable **22** is pre-connectorized so that the drop cable **22** can be readily

interconnected with the connectorized optical fiber **24** of the distribution cable **26**, as will be described. Thus, the pedestal **20** provides a convenient branch point in a fiber optic network for a field technician to initially install and subsequently reconfigure optical connections between the distribution cable **26** and a pre-connectorized drop cable **22** to provide communications service to a subscriber.

[0025] The pedestal **20** shown in FIG. 1 typically extends only about two to three feet above the surface of the ground **18**. A housing **28** is positioned over a conventional pedestal base **30** or onto a similar base incorporated into a below-grade vault or hand hole. The base **30** shown defines an integral stake feature **32** and is self-supporting. However, the base **30** and housing **28** may also be stake-mounted on the ground or pole-mounted above the ground. Both the base **30** and the housing **28** are preferably made of a flame, impact and UV-resistant material designed to provide security for the optical fiber terminations and to protect the optical fibers, optical connections and optical components in a buried plant environment. In addition, the pedestal **20** may be molded from resins designed to resist environmental degradation. The housing **28** is generally hollow so as to create a "bell-jar" effect when positioned over the base **30**. As shown, the housing **28** is cylindrical in shape and has a relatively thin outer wall. However, the housing **28** may have any desired shape, such as square, rectangular, oval or irregular, and the outer wall may have any suitable thickness. In certain embodiments the housing **28** is removable so that 360 degree substantially unrestricted access is available to the field technician with the housing **28** removed. The bell-jar effect significantly reduces the likelihood that the optical fibers, optical connections and any electrical or optical components housed within the upper portion of the pedestal will be submerged in water in the event of a flood condition. The housing **28** may be secured to the base **30** using any suitable securing means, such as conventional fasteners or a bayonet type fitting, in a known manner.

[0026] The base **30** defines at least one slot **34** for permitting the distribution cable **26** and the one or more drop cables **22** to enter and exit the pedestal **20**. The slot **34** allows the cables to be installed without having to trench deep into the ground below the bottom of the base **30**. Accordingly, the ground in the immediate vicinity of the base **30** can be excavated by hand and the cables **26, 22** can enter the pedestal **20** through the slot **34** formed in the upper portion of the base **30**. In an alternative embodiment (not shown), the distribution cable **26** and the

one or more drop cables **22** may enter the pedestal **20** through the open bottom of the base **30**, such as in a below-grade vault or hand hole installation. Additional slots **34** (indicated by dashed lines in FIG. 1) may be provided around the periphery of the base **30** to permit the distribution cable **26** and the one or more drop cables **22** to enter or exit the pedestal **20** at more convenient locations, or from different directions. The slots **34** may be initially covered by perforated tabs that are configured to be easily broken away from the base **30**, as desired. The distribution cable **26** is routed from the base **30** into an interior cavity defined by the pedestal **20** within the housing **28**. As shown, the distribution cable **26** is then routed to a cable port **36** provided on a mounting plate **38** secured to an interior wall of the housing **28** that separates the interior cavity into an upper first compartment **40** and a lower second compartment **42**. The distribution cable **26** passes from the second compartment **42** through the cable port **36** into the first compartment **40**, which houses the mid-span access location including the terminated optical fibers **24**. The distribution cable **26** is then routed back to the mounting plate **38** and exits the first compartment **40** through another cable port **36** provided on the mounting plate **38** into the second compartment **42**. The distribution cable **26** is preferably sealed and strain relieved at the cable entrance and exit ports **36** in a known manner. In an alternative embodiment, each cable opening **36** may be defined by two halves of a mounting plate that is brought together and secured around the distribution cable **26**. If desired, conventional fasteners or epoxy adhesive may be used to secure the mounting plate to the interior wall of the housing **28** or around the distribution cable **26**.

[0027] The mounting plate **38** is oriented generally perpendicular to the interior wall of the housing **28** (i.e., horizontal) and is shaped to conform to the contour of the interior wall. As shown, the housing is cylindrical shaped and has a relatively thin, constant thickness wall. Accordingly, the mounting plate **38** is circular shaped and may be provided with an O-ring or other type seal (not shown) around its outer edge to seal between the mounting plate **38** and the interior wall of the cylindrical housing **28**. Preferably, the mounting plate **38** is secured to the underside of an annular ring **50** affixed to the interior wall of the housing **28**. A rubber gasket or other type seal (not shown) may be positioned between the underside of the ring **50** and the mounting plate **38**. In the embodiment shown in FIG. 1, the mounting plate **38** serves as a bulkhead having a plurality of connector ports **44** mounted on the mounting plate **38**. Unoccupied ports may be sealed using caps or plugs **46** until needed. As will be appreciated,

the configuration and the size of the mounting plate **38** will vary depending on the number of connector ports **44**, the number and size of the cable ports **36** and the inner diameter of the housing **28**.

[0028] The exemplary embodiment illustrated in FIG. 1 comprises five connector ports **44** for interconnecting up to five pre-connectorized drop cables **22** to terminated and connectorized optical fibers **24** of the distribution cable **26**. Although five connector ports **44** are shown in this particular embodiment, it is envisioned that the housing **28** and the mounting plate **38** may be designed to accommodate any number of connector ports **44**. Typically, however, the housing **28** and the mounting plate **38** are configured with no less than four and no more than twelve connector ports **44**. Thus, it is conceivable that the pedestal **20** may accommodate any number of pre-connectorized drop cables **22**, for example, one, two, three, four, six, eight, twelve, etc. As used herein, the term "connector port" is intended to include an opening through the mounting plate **38** at which the connector mounted upon the end of the terminated and connectorized optical fiber **24** of the distribution cable **26** is optically connected to the connector of a pre-connectorized drop cable **22**. The connector port **44** may also include a factory-installed connector housing and connector adapter sleeve (not shown) for aligning and maintaining the mating connectors in physical contact. In one embodiment, the connector adapter sleeve may be biased within the adapter to ensure physical contact between the opposed end faces of the connectors. Preferably, the connector ports **44** further provide an environmental seal at the optical connection between the connectorized optical fiber **24** of the distribution cable **26** and the pre-connectorized drop cable **22**. The connector ports **44** also transfer any tension load of the cables on each side of the connector ports **44** to a connector port mounting, which in turn transfers any tension load to the mounting plate **38** and the housing **28**.

[0029] As stated above, the pedestal **20** defines an interior cavity for housing the mounting plate **38**, the distribution cable **26**, connectorized optical fibers **24**, one or more drop cables **22** and any optical components needed to connectorize optical fibers of the distribution cable **26**, or to couple an optical fiber of the distribution cable **26** with an optical fiber of the drop cable **22**. For example, the optical components may comprise a coupler, an adapter, an optical fiber routing guide, a slack storage hub, or the like. As shown, the optical components comprise a

conventional splice tray **48** mounted on a bracket **54** secured to the ring **50**. The splice tray **48** and bracket **54** may also be secured to the mounting plate **38** so that the splice tray **48** may be inserted into and removed from the interior cavity in conjunction with the mounting plate **38**. Regardless, the mounting plate **38** separates the interior cavity into the first compartment **40** and the second compartment **42**, as previously described. The mid-span access location, the connectorized optical fibers **24** and the optical components are housed within the first compartment **40**. The second compartment **42** provides access to the connector ports **44** on the underside of the mounting plate **38** to which the drop cables **22** are connected. The optical fibers **24** of the distribution cable **26** are terminated at the mid-span access location and spliced to the connectorized optical fibers within the splice tray **48** in the first compartment **40**. The terminated and connectorized optical fibers **24** are then routed to and connected to the connector ports **44** on the upper side of the mounting plate **38** within the first compartment **40**. Thus, the first compartment **40** serves the same function as, and replaces, a conventional splice closure having a plurality of cable entrance and exit ports and a plurality of connector ports in an end wall for interconnecting optical fibers **24** of the distribution cable **26** with respective optical fibers of one or more drop cables **22**. With the mounting plate **38** sealed against the interior wall of the housing **28** and the ring **50**, and with the cable ports **36** and connector ports **46** sealed as previously mentioned, the mounting plate **38** serves to substantially seal the first compartment **40** relative to the second compartment **42**. In particular, the first compartment **40** forms a first air pocket, preferably at a slightly higher air pressure than the second compartment **42**. The second compartment **42** forms a second air pocket below the first air pocket when the housing **28** is positioned over the base **30**. With the housing **28** positioned over the base **30**, the second compartment **42** creates a "bell jar" effect that further acts to prevent water from entering the first compartment **40**. In particular, water entering the interior cavity at the base **30** of the pedestal **20** compresses the air in the second compartment **42** upwardly, thereby increasing the pressure in the second compartment **42** relative to the ambient pressure outside the pedestal **20**. Thus, a substantially sealed "splice closure" is created inside the pedestal **20** without the need for an additional enclosure to be housed within the interior cavity defined by the pedestal. As a result, the overall size of the optical termination pedestal **20** may be maintained smaller, or a greater number of drop cables may be interconnected within a pedestal of the same size.

[0030] Referring to FIG. 2, an optical termination pedestal **20** constructed in accordance with another exemplary embodiment of the present invention is shown. In this embodiment, the mounting plate **38** is secured to the base **30**, instead of being secured to the housing **28** as in the previous embodiment. Thus, the housing **28** is removable from the mounting plate **38** and the base **30**. As previously described, the distribution cable **26** enters the first compartment **40** through a cable port **36** provided in the mounting plate **38**, and exits the first compartment through another cable port **36** provided in the mounting plate **38**. At least one, and preferably a plurality of mounting brackets **52** affix the mounting plate **38** to the base **30**. As previously described, a bracket **54** secures a conventional splice tray **48** to the mounting plate **38**. It will be readily apparent and well understood by one of ordinary skill in the art that inside the splice tray **48**, a terminated optical fiber **24** of the distribution cable **26** is spliced to a relatively short length of optical fiber having a connector mounted on the end (i.e., a pigtail **56**) in any known manner, such as by fusion splicing or mechanical splicing. The splice tray **48** is adapted to receive any number of splices. Furthermore, more than one splice tray **48** may be provided to accommodate splicing additional optical fibers **24** of the distribution cable **26** to pigtails **56**. In the case of more than one splice tray **48**, the splice trays may be positioned in a stacked relationship and retained in a known manner, such as by a strap, or as shown, by a nut **55** secured on a threaded mounting post. The bracket **54** may also be used to secure other optical components to the mounting plate **38**, such as couplers, adapters, optical fiber routing guides, slack storage hubs and the like. Strain relief members (not shown) may also be secured to the mounting plate **38** or to the brackets **52**, **54**. The strain relief members provide strain relief for the distribution cable **26** or the fiber optic drop cables **22** within the interior cavity defined by the pedestal **20**.

[0031] While the mounting plate **38** depicted in FIG. 1 is attached to the housing **28** and remains with the housing **28** when the housing **28** is separated from the base **30**, the mounting plate **38** depicted in FIG. 2 is attached to the base **30** and remains with the base **30** when the housing **28** is removed from the base **30**. As a result, a field technician is provided with 360 degree substantially unrestricted access to the mid-span access location, including terminated optical fibers **24**, splice tray **48**, pigtails **56**, and cable ports **36** and connector ports **44** on the mounting plate **38**, when the housing **28** is removed. As previously described with respect to the embodiment shown in FIG. 1, pigtail **56** is routed within the first compartment **40** of the

housing **28** and connector **58** is connected to one side of a connector port **44**. With the housing **28** removed as shown, the interior cavity of the pedestal **20** is readily accessible to a field technician initially installing the pigtails **56** and connectors **58** into the respective connector ports **44**. The field technician may create and route additional pigtails **56** and connectors **58** to the unused connector ports **44** for future use, or may remove or rearrange existing optical connections between previously installed connectors **58** and the connector ports **44**. Once the pedestal **20** is initially installed, the field technician may also add, remove or rearrange optical connections between optical fibers of the pre-connectorized drop cables **22** and the other side of the respective connector ports **44**. Thus, additional drop cables can be connected to the unused connector ports **44** without disturbing the previously installed pigtails **56** and connectors **58**. As previously described, an O-ring or other seal is provided on the outer edge of the mounting plate **38** to substantially seal the first compartment **40** relative to the second compartment **42** when the housing **28** is positioned over the base **30**. As in the previous embodiment, the second compartment **42** creates a "bell jar" effect that further acts to prevent water from entering the first compartment **40**. Thus, a substantially sealed splice closure is created inside the pedestal **20** without the need for an additional enclosure to be housed within the interior cavity defined by the pedestal **20**. As a result, the overall size of the optical termination pedestal **20** may be maintained smaller, or a greater number of drop cables may be interconnected within a pedestal of the same size.

[0032] Referring to FIG. 3, an optical termination pedestal **20** constructed in accordance with another exemplary embodiment of the present invention is shown with one or more access doors **58** in an opened position. Preferably, the access doors **58** are hingedly affixed to the housing **28** at one or more hinge locations **60**. Regardless, the access doors **58** are movable between an opened position for providing access to the first and second compartments **40, 42** within the interior cavity defined by the pedestal **20**, and a closed position for securing and sealing the interior cavity defined by the pedestal **20**. The access doors **58** are operable for providing access for a field technician to initially configure the pedestal **20** or to subsequently add, remove or reconfigure optical connections. Any optical components within the interior cavity are positioned so as to not interfere with the movement of the access doors **58** between the opened and closed positions. As shown, the access doors **58** are rotatable relative to the housing **28** through an angle of at least about 90 degrees and as much as about 180 degrees

between the opened position and the closed position, thus providing convenient and substantially unrestricted access to the first compartment **40** and the second compartment **42** within the interior cavity. Alternatively, the access doors **58** may be removably attached to the housing **28** to provide unobstructed access to the interior cavity. The access doors **58** may be provided with a security lock or other means for securing the access doors **58** in the closed position, thereby deterring unauthorized persons from accessing the interior cavity defined by the pedestal **20**. Furthermore, the outer edge of the access doors **58** may be provided with a rubber gasket or other seal for sealing the interior cavity against adverse environmental conditions, such as dust, dirt, infestation and moisture. As previously described, an O-ring or other seal is provided on the outer edge of the mounting plate **38** to substantially seal the first compartment **40** relative to the second compartment **42** when the housing **28** is positioned over the base **30**. As in the previous embodiments, the second compartment **42** creates a "bell jar" effect that further acts to prevent water from entering the first compartment **40**. Thus, a substantially sealed splice closure is created inside the pedestal **20** without the need for an additional enclosure to be housed within the interior cavity defined by the pedestal **20**. As a result, the overall size of the optical termination pedestal **20** may be maintained smaller, or a greater number of drop cables may be interconnected within a pedestal of the same size.

[0033] Referring to FIGS. 4 and 5, a pedestal **20** constructed in accordance with another exemplary embodiment of the present invention is shown with a sliding ring **62** that is movable between a closed position and an opened position. The ring **62** overlaps a lower portion of the housing **28** and an upper portion of the base **30** and is configured so that it may be moved up and down relative to the base **30** and the housing **28** to provide substantially unrestricted access to the second compartment **42** within the interior cavity defined by the pedestal **20** from below the housing **28**. The ring **62** is shown in the lowered and closed position in FIG. 4, and is shown in the raised and opened position in FIG. 5. The access to the second compartment **42** provided by the ring **62** allows a field technician to readily connect a pre-connectorized drop cable **22** to one side of a connector port **44** on the underside of the mounting plate **38**. The housing **28** is supported at a predetermined position above the base **30** by one or more brackets **52** and the mounting plate **38** is preferably secured to a ring **50** affixed to the interior wall of the housing **28**. As previously described, an O-ring or other seal is provided on the outer edge of the mounting plate **38** to substantially seal the first

compartment **40** relative to the second compartment **42** when the housing **28** is positioned over the base **30**. As in the previous embodiments, the second compartment **42** creates a "bell jar" effect (with the ring **62** in the lowered and closed position) that further acts to prevent water from entering the first compartment **40**. Thus, a substantially sealed splice closure is created inside the pedestal **20** without the need for an additional enclosure to be housed within the interior cavity defined by the pedestal **20**. As a result, the overall size of the optical termination pedestal **20** may be maintained smaller, or a greater number of drop cables may be interconnected within a pedestal of the same size.

[0034] Referring to FIG. 6, a pedestal **20** constructed in accordance with another exemplary embodiment of the present invention is shown with a plurality of connector ports **44** mounted on a vertical mounting plate **64**. In this embodiment, the mounting plate **38** is oriented generally perpendicular to the interior wall of the housing **28** (i.e., horizontal) as in the previous embodiments. However, the pedestal **20** further comprises a vertical mounting plate **64** affixed to the upper side of the mounting plate **38** and extending upwardly to the underside of the housing **28**. Instead of separating the interior cavity defined by the pedestal **20** into an upper first compartment **40** and a lower second compartment **42** with a horizontal mounting plate **38**, the interior cavity is separated into a forward first compartment **40** and a rearward second compartment **42** by the vertical mounting plate **64** so that the first and second compartments **40**, **42** are arranged side by side within the upper portion of the housing **28**. The mounting plate **38** has a pair of sealed cable entrance and exit ports **36** for receiving the distribution cable **26** and routing the distribution cable **26** into and out of the first compartment **40**. The mounting plate **38** further has at least one, and preferable a plurality of drop cable openings (obscured) for passing one or more pre-connectorized fiber optic drop cables **22** into the second compartment **42**. Any empty drop cable openings in mounting plate **38** may be fitted with a cap or plug (not shown) so that the second compartment **42** is protected against dirt, dust and infestation. One or more access doors **58** may be hingedly affixed to the housing **28**, thus allowing the access doors **58** to be rotated between an opened position for providing access to the first and second compartments **40**, **42**, and a closed position for sealing and securing the pedestal **20**. As previously stated, the access doors **58** are operable for providing substantially unrestricted access to a field technician initially installing the pedestal **20** or subsequently reconfiguring the optical connections.

[0035] The distribution cable **26** is routed through a slot **34** provided in the base **30** and into the interior cavity defined by the pedestal **20**. The distribution cable **26** is then routed through one of the cable ports **36** provided on the mounting plate **38** and into the first compartment **40** so that the mid-span access location on the distribution cable **26** is housed within the first compartment **40**. The terminated optical fibers of the distribution cable **26** are then connectorized and routed to one side of the connector ports **44** from the first compartment **40**. The distribution cable **26** exits the first compartment **40** through the other cable port **36** and exits the pedestal **20** through the slot **34** provided in the base **30**. The distribution cable **26** is preferably sealed and strain relieved at the cable ports **36** in any suitable and known manner. The pre-connectorized drop cables **22** are likewise routed through a slot **34** provided in the base **30** and into the interior cavity defined by the pedestal **20**. The drop cables **22** are then routed into the second compartment **42** through the drop cable openings provided in the mounting plate **38**. The pre-connectorized drop cables **22** are then connected to the other side of the connector ports **44** from the second compartment **42**. At least a portion of the horizontal mounting plate **38** and the vertical mounting plate **64** are provided with an O-ring or other seal along their outer edges to seal the respective portions of the mounting plate **38** and the mounting plate **64** to the interior wall and the underside of the housing **28**. As shown, only the semi-circular portion of the mounting plate **38** adjacent the first compartment **40** is provided with an O-ring or other seal so that the terminated optical fibers, any optical components and the optical connections within the first compartment **40** are sealed against adverse environmental conditions, such as dust, dirt, infestation and moisture, and in particular a flood condition. Typically, the optical connections in the second compartment **42** between the pre-connectorized drop cables **22** and the connector ports **44** are sealed in a suitable manner. However, if desired, the entire outer edge of the horizontal mounting plate **38** may be provided with an O-ring or other seal to further protect the optical connections within the second compartment **42**. The O-ring or other seal provided on the outer edge of the mounting plate **38** and the mounting plate **64** substantially seals the first compartment **40** relative to the second compartment **42** when the housing **28** is positioned over the base **30**. In this embodiment, the interior cavity below the first and second compartments **40, 42** creates a "bell jar" effect (with the mounting plate **38** secured to the interior wall of the housing **28**) that further acts to prevent water from entering the first compartment **40**. Thus, a

substantially sealed splice closure is created inside the pedestal **20** without the need for an additional enclosure to be housed within the interior cavity defined by the pedestal **20**. As a result, the overall size of the optical termination pedestal **20** may be maintained smaller, or a greater number of drop cables may be interconnected within a pedestal of the same size.

[0036] Referring to FIG. 7, an optical termination pedestal **20** constructed in accordance with another exemplary embodiment of the present invention is shown. The pedestal **20** permits an optical fiber of one or more fiber optic drop cables **22** to be spliced in the field with a field-terminated or factory-preterminated optical fiber **24** of a fiber optic distribution cable **26**. In this embodiment, the terminated optical fiber **24** is not connectorized. As is well known and understood in the art, a terminated or preterminated optical fiber **24** of the distribution cable **26** and an optical fiber of a drop cable **22** may be fusion or mechanically spliced and retained within a conventional splice tray **48** adapted to receive any number of splices. In the case of more than one splice tray **48**, the splice trays **48** may be positioned in a stacked relationship and retained in a known manner, such as by a strap, or as shown by a nut **55** secured on a threaded mounting post. A bracket **54** may be used to secure the splice tray **48**, as well as other optical components, such as couplers, adapters, optical fiber routing guides, slack storage hubs and the like, to the mounting plate **38**.

[0037] The distribution cable **26** is routed through a slot **34** provided in the base **30** and into the interior cavity defined by the pedestal **20**. The distribution cable **26** is then routed through one of the cable ports **36** provided on the mounting plate **38** and into the first compartment **40** so that the mid-span access location on the distribution cable **26** is housed within the first compartment **40**. The field-terminated or factory-preterminated optical fibers **24** of the distribution cable **26** are then routed to the splice tray **48** within the first compartment **40**. The distribution cable **26** exits the first compartment **40** through the other cable port **36** and exits the pedestal **20** through the slot **34** provided in the base **30**. The distribution cable **26** is preferably strain relieved at the cable ports **36** in any suitable and known manner. The fiber optic drop cables **22** are likewise routed through a slot **34** provided in the base **30** and into the interior cavity defined by the pedestal **20**. The drop cables **22** are then routed into the first compartment **40** through one or more drop cable openings **66** provided in the mounting plate **38**. The drop cables **22** are next routed into the splice tray **48** and mechanically or fusion

spliced to the terminated or preterminated optical fibers **24** of the distribution cable **26** in a known manner. The cable ports **36** and the drop cable openings **66** are sealed in any suitable and known manner. The mounting plate **38** is provided with an O-ring or other seal along the outer edge to seal the mounting plate **38** to the interior wall of the housing **28** so that the first compartment **40** is protected against adverse environmental conditions, such as dust, dirt, infestation and moisture, and in particular a flood condition. The O-ring or other seal provided on the outer edge of the mounting plate **38** substantially seals the first compartment **40** relative to the second compartment **42** when the housing **28** is positioned over the base **30**. As in previous embodiments, the second compartment **42** creates a "bell jar" effect (with the mounting plate **38** secured to the interior wall of the housing **28**) that further acts to prevent water from entering the first compartment **40**. Thus, a substantially sealed splice closure is created inside the pedestal **20** without the need for an additional enclosure to be housed within the interior cavity defined by the pedestal **20**. As a result, the overall size of the optical termination pedestal **20** may be maintained smaller, or a greater number of drop cables may be interconnected within a pedestal of the same size.

[0038] Referring to FIG. 8, an optical termination pedestal **20** constructed in accordance with another exemplary embodiment of the present invention is shown. The pedestal **20** permits an optical fiber of one or more fiber optic drop cables **22** to be optically connected with a field-terminated or factory-preterminated optical fiber **24** of a fiber optic distribution cable **26**. In this embodiment, the terminated or preterminated optical fibers **24** are direct connectorized. Alternatively, a field-installable connector may be fusion spliced or mechanically spliced onto the ends of the optical fibers **24** in a known manner. The optical fibers of the drop cables **22** are pre-connectorized, or alternatively, a field-installable connector is likewise fusion spliced or mechanically spliced onto the ends of the optical fibers of the drop cables **22**. As is well known and understood in the art, a connectorized optical fiber **24** of the distribution cable **26** and a connectorized optical fiber of a drop cable **22** may be optically connected by a means for interconnecting, for example, a conventional connector adapter sleeve **68**. As shown, a plurality of connector adapter sleeves **68** may be positioned in a linear arrangement and retained in a known manner, such as by a strap or other fastener. A bracket **54** may be used to secure the connector adapter sleeves **68**, as well as any other passive or active electrical, optical or electro-optical components **70**, such as a power source, printed circuit board,

splitter, amplifier, division wave multiplexer (DWM), or the like, to the mounting plate **38**. The mounting plate **38** in turn may be secured to the base **30** by at least one bracket **52** so that the housing **28** can be removed from the base **30** to provide a field technician with essentially unobstructed access to the first compartment **40** and the second compartment **42** within the interior cavity defined by the pedestal **20**.

[0039] The distribution cable **26** is routed through a slot **34** provided in the base **30** and into the interior cavity defined by the pedestal **20**. The distribution cable **26** is then routed through one of the cable ports **36** provided on the mounting plate **38** and into the first compartment **40** so that the mid-span access location on the distribution cable **26** is housed within the first compartment **40**. The terminated or preterminated optical fibers **24** of the distribution cable **26** are then connectorized and routed into one side of the connector sleeve adapters **68** within the first compartment **40**. The distribution cable **26** exits the first compartment **40** through the other cable port **36** and exits the pedestal **20** through the slot **34** provided in the base **30**. The distribution cable **26** is preferably strain relieved at the cable ports **36** in any suitable and known manner. The fiber optic drop cables **22** are likewise routed through a slot **34** provided in the base **30** and into the interior cavity defined by the pedestal **20**. The drop cables **22** are then routed into the first compartment **40** through one or more drop cable openings **66** provided in the mounting plate **38**. The drop cables **22** are next connectorized (if not pre-connectorized) and routed into the other side of the connector adapter sleeves **68** so that optical fibers of the drop cables **22** are optically connected to the connectorized optical fibers **24** of the distribution cable **26** in a known manner. The cable ports **36** and the drop cable openings **66** are sealed in any suitable and known manner. The mounting plate **38** is provided with an O-ring or other seal along the outer edge to seal the mounting plate **38** to the interior wall of the housing **28** so that the first compartment **40** is protected against adverse environmental conditions, such as dust, dirt, infestation and moisture, and in particular a flood condition. The O-ring or other seal provided on the outer edge of the mounting plate **38** substantially seals the first compartment **40** relative to the second compartment **42** when the housing **28** is positioned over the base **30**. As in previous embodiments, the second compartment **42** creates a "bell jar" effect (with the housing **28** positioned over the mounting plate **38** and the base **30**) that further acts to prevent water from entering the first compartment **40**. Thus, a substantially sealed splice closure is created inside the pedestal **20**

without the need for an additional enclosure to be housed within the interior cavity defined by the pedestal **20**. As a result, the overall size of the optical termination pedestal **20** may be maintained smaller, or a greater number of drop cables may be interconnected within a pedestal of the same size.

[0040] In all embodiments described above, the pedestal **20** may be either sealed or ventilated. In a further embodiment, the same concept of combining the functions of a conventional splice closure and a conventional pedestal may be applied to a below-grade vault or hand hole installation. In a particular example, a below-grade vault may incorporate a plate or bulkhead for mounting the connector ports and provide a splicing compartment so that a splice closure having a separate enclosure inside the vault is not required. In a still further embodiment, the base may be designed with a plate or bulkhead affixed to an interior wall of the base such that the connector ports can be exposed when the housing is lifted off the base.

[0041] The exemplary embodiments of an optical termination pedestal according to the present invention shown and described herein provide a number of significant advantages over previously known pedestals that contain conventional splice closure. For purposes of example only, and not by way of limitation, a pedestal constructed in accordance with the invention provides a field technician with the ability to readily connect, disconnect and reconfigure pre-connectorized fiber optic drop cables to "quick connect" connector ports located within an interior cavity defined by the pedestal. In addition, connectorized optical fibers of the distribution cable can be routed to the connector ports during initial installation and retained within a substantially sealed first compartment. Thereafter, a field technician is not required to enter the sealed first compartment to make subsequent optical connections of the pre-connectorized drop cables to the terminated or preterminated optical fibers of the distribution cable. Thus, the pedestal of the present invention eliminates the need to perform fusion or mechanical splices in the field once the optical fibers of the distribution cable are terminated and connectorized. It should be noted that a pedestal constructed in accordance with the invention permits terminated or preterminated optical fibers of a distribution cable to be interconnected with respective optical fibers of one or more drop cables in numerous different configurations.

[0042] The foregoing is a description of various embodiments of the invention that are given here by way of example only. Although optical termination pedestals have been described with reference to preferred embodiments and examples thereof, other embodiments and examples may perform similar functions and/or achieve similar results. All such equivalent embodiments and examples are within the spirit and scope of the present invention and are intended to be covered by the appended claims.